

Status of Tropospheric Emissions: Monitoring of Pollution (TEMPO)

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TEMPO is now well into its implementation phase, having passed both its Key Decision Point C and the Critical Design Review (CDR) for the instrument in 2015. The CDR for the ground systems will occur in May 2016 and the CDR for the Mission component at a later date, after the host spacecraft has been selected. TEMPO is on schedule to measure atmospheric pollution for greater North America from space using ultraviolet and visible spectroscopy. TEMPO measures from Mexico City to the Canadian oil sands, and from the Atlantic to the Pacific, hourly and at high spatial resolution. TEMPO provides a tropospheric measurement suite that includes the key elements of tropospheric air pollution chemistry. Measurements are from geostationary (GEO) orbit, to capture the inherent high variability in the diurnal cycle of emissions and chemistry. The small product spatial footprint resolves pollution sources at sub-urban scale. Together, this temporal and spatial resolution improves emission inventories, monitors population exposure, and enables effective emission-control strategies.

TEMPO takes advantage of a GEO host spacecraft to provide a modest cost mission that measures the spectra required to retrieve O₃, NO₂, SO₂, H₂CO, C₂H₂O₂, H₂O, aerosols, cloud parameters, and UVB radiation. TEMPO thus measures the major elements, directly or by proxy, in the tropospheric O₃ chemistry cycle. Multi-spectral observations provide sensitivity to O₃ in the lowermost troposphere, substantially reducing uncertainty in air quality predictions by 50%. TEMPO quantifies and tracks the evolution of aerosol loading. It provides near-real-time air quality products that will be made widely, publicly available.

TEMPO provides much of the atmospheric measurement capability recommended for GEO-CAPE in the 2007 National Research Council Decadal Survey, Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond. Instruments from Europe (Sentinel 4) and Asia (GEMS) will form parts of a global GEO constellation for pollution monitoring later this decade, with a major focus on intercontinental pollution transport. As the first selected NASA Earth Venture Instrument, TEMPO will launch at a prime time to be a component of this constellation.